11. RI/FS SUMMARY AND CONCLUSIONS

This section summarizes the list of WAG 9 retained sites, nature and extent of contamination, human health risk assessment, and ecological risk assessment that were evaluated in this Comprehensive Remedial Investigation/Feasibility Study (RI/FS) for Argonne National Laboratory Operable Unit 9-04. This section also outlines which release sites will be evaluated in the feasibility study and the steps necessary to provide integration between RCRA and CERCLA organizations for closure of ANL-01A (Main Cooling Tower Blowdown Ditch) Land Disposal Unit (LDU).

11.1 Retained Sites Summary

All sites within WAG 9 that were identified in the FFA/CO Agreement were screened using the site and contaminant screening methodologies presented in Guidance Protocol of Cumulative Risk Assessments at the INEL (LITCO 1995). The complete screening procedure is presented in Section 3.1 of this document. In the site screening, two primary criteria for retaining a site are (a) if a COPC exists for a site, or (b) if a data gap on a site exists. The steps to complete the site screening are presented below:

1. Compile information for WAG 9 sites.

2. Identify newly identified and unevaluated sites.

3. Eliminate No Action sites and sites for which a source does not exist.

4. Eliminate sites for which no contamination was detected or the risk was determined to be less than 1E-06 and the hazard quotient less than 1 as a result of previous risk evaluation activities (e.g., Track 1, Track 2, or other investigations), if less than 10 sites are eliminated by this step.

5. Retain sites containing known contamination for further evaluation against the contaminant screening criteria.

In Step 4, if greater than 10 sites are eliminated using this step, then the risk screening level is 1E-07 and the screening hazard quotient is 0.1.

Table 11-1 shows that of the 37 sites identified in the FFA/CO Agreement, only seven sites were retained and evaluated under the OU 9-04 comprehensive RI/BRA. The seven retained sites included one Track 1 site (ANL-61A), one Track 2 site (ANL-08), and five RI/FS sites (ANL-01A, ANL-01, ANL-09, ANL-35, and ANL-35).

11.2 Contamination Nature and Extent Summary

After identifying which WAG 9 sites will be retained in the BRA, the next step is to identify the nature and extent of the contamination at each retained site. The nature of contamination determines which contaminants exceed the INEEL background concentrations while the extent of contamination determines the volume of the contaminated media.

Table 11-1. Summary of potential release sites retained or eliminated from risk evaluation of WAG 9.

OU	Subunit	Site description	Type of investigation	Eliminate/retain	Reason for elimination
None	ANL-10	Dry Well between T-1 and ZPPR Mound	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-11	Waste Retention Tank 783	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-12	Suspect Waste Retention Tank by 793	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-14	Septic Tank and Drain Fields (2) by 753	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-15	Dry Well by 768	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-16	Dry Well by 759 (2)	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-17	Dry Well by 720	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-18	Septic Tank and Drain Field by 789	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-20	Septic Tank and Drain Field by 793	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-21	TREAT Suspect Waste Tank and Leaching Field (Non-radioactive)	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-22	TREAT Septic Tank and Leaching Field	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-23	TREAT Seepage Pit and Septic Tank West of 720	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-24	Lab and Office Acid Neutralization Tank	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-25	Interior Building Coffin Neutralization Tank	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-26	Critical Systems Maintenance Degreasing Unit	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-27	Plant Services Degreasing Unit	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-32	TREAT Control Building 721 Septic Tank and Leach Field (present)	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
None	ANL-33	TREAT Control Building 721 Septic Tank and Seepage Pit	Environmental characterization	Eliminate	Screening methodology Step 3: no source.
9-01	ANL-04	ANL Sewage Lagoons	Track 1	Eliminate	Screening methodology Step 3: no source.
9-01	ANL-19	Sludge Pit West of T-7 (Imhoff Tank)	Track 1	Eliminate	Screening methodology Step 3: no source.

OU	Subunit	Site description	Type of investigation	Eliminate/retain	Reason for elimination
9-01	ANL-28	EBR-II Sump	Track 1	Eliminate	Screening methodology Step 3: no source.
9-01	ANL-29	Industrial Waste Lift Station	Track 1	Eliminate	Screening methodology Step 4: Eliminate per Track 1 findings risk <1E-06.
9-01	ANL-30	Sanitary Waste Lift Station	Track 1	Eliminate	Screening methodology Step 4: Eliminate per Track 1 findings risk <1E-06.
9-01	ANL-36	TREAT Photo Processing Discharge Ditch	Track 1	Eliminate	Screening methodology Step 4: Eliminate per Track 1 findings risk <1E-06.
9-01	ANL-60	Knawa Butte Debris Pile	Track 1	Eliminate	Screening methodology Step 3: no source.
9-01	ANL-61	EBR-II Transformer Yard	Track 1	Eliminate	Screening methodology Step 4: Eliminate per Track 1 findings risk <1E-06.
9-01	ANL-61A	PCB-contaminated soil adjacent to ANL-61	No previous investigation	Retain	
9-01	ANL-62	Sodium Boiler Building (766) Hotwell	Track 1	Eliminate	Screening methodology Step 3: no source
9-01	ANL-63	Septic Tank 789-A	Track 1	Eliminate	Screening methodology Step 3: no source
9-02	ANL-08	EBR-II Leach Pit (Radioactive)	Track 2	Retain	Removed contamination in 1991, retained for evaluation of the vadose zone.
9-03	ANL-05	ANL Open Burn Pits #1, #2, and #3	Track 2	Eliminate	Screening methodology step 4: eliminate per Track 2 finding risk < 1E-06
9-03	ANL-31	Industrial/Sanitary Waste Lift Station (Industrial Side Not Used)	Track 2	Eliminate	Screening methodology step 3: no source.
9-03	ANL-34	Fuel Oil Spill by Building 755	Track 2	Eliminate	Screening methodology Step 4: Eliminate because Track 2 findings risk <1E-06.
9-04	ANL-01	Industrial Waste Pond and Cooling Tower Blowdown Ditches (3)	RI/FS	Retain	
9-04	ANL-01A	Main Cooling Tower Blowdown Ditch	RI/FS	Retain	
9-04	ANL-09	ANL Interceptor Canal	RI/FS	Retain	
9-04	ANL-35	Industrial Waste Lift Station Discharge Ditch	RI/FS	Retain	
9-04	ANL-53	Cooling Tower Riser Pits	RI/FS	Retain	

The nature and extent of contamination for each site was completed in Chapter 4. The nature and extent of the contamination is used to assess the physical dimensions of the potentially contaminated area for each of the WAG 9 sites. The extent of contamination will be used in the modeling of the migration of contaminants to the groundwater, the human health risk assessment, and the ecological risk assessment. The nature of the contamination for each release site is presented in Tables 3-3 through 3-18 of this document.

11.3 Human Health Risk Evaluation Summary

The OU 9-04 human health risk assessment consists of reviewing the retained sites (Section 3) to determine the nature and extent of contaminants at those sites (Section 4), and to determine if there are any potential adverse human health impacts to current and future workers and potential future residents at WAG 9. To accomplish this, the exposure routes to these receptors need to be determined. The exposure route analysis includes an exposure assessment, a toxicity assessment, and a risk characterization discussion. As described in Chapter 5 of the RI/BRA, the BRA includes an evaluation of human health risks associated with exposure to contaminants through soil ingestion, fugitive dust inhalation, volatile inhalation, external radiation exposure, groundwater ingestion, ingestion of homegrown produce, dermal absorption of groundwater, dermal absorption from soil, and inhalation of water vapors due to indoor water use.

Table 11-2 presents a complete list of exposure scenarios, exposure pathways, and risks for OU 9-04 sites that exceeded the lower limit of the NCP target risk range(1E-06). Table 11-3 presents the OU 9-04 sites that exceeded the upper limit of the NCP target risk range (1E-04) and the exposure scenarios, exposure pathways, and risks associated with these sites. The sites with hazard indexes that were 1 or greater are presented in Table 11-4 with their respective exposure pathway, scenario, and hazard quotients. The information presented in Table 11-2, 11-3, and 11-4 was used to determine which sites would be retained for evaluation in the feasibility study. Table 11-5 shows the OU 9-04 release sites that were retained for evaluation in the feasibility study, because of the risks to human health.

11.4 Ecological Risk Evaluation Summary

The objectives of the OU 9-04 WAG Ecological Risk Assessment (ERA) was to define the extent of contamination for each site at the WAG level; determine the potential effects from contaminants on environmental receptors, habitats, or special environments; determine the potential effects from contaminants on other ecological receptors at WAG 9; and identify sites and COPCs to be assessed at the INEEL-wide ERA. The approach used in the WAG 9 ERA is an extension of the screening level ecological risk assessment methodology used at the INEEL (VanHorn et al. 1995). This methodology uses conservative exposure modeling and input parameters to identify contaminants and sites that may pose a risk to the environment.

The WAG 9 ERA incorporates levels of uncertainty that could either overestimate or underestimate the actual risk to environmental receptors. To compensate for potential uncertainties, the WAG 9 ERA incorporates various adjustment factors that are designed to be conservative rather than result in a conclusion of no indication of risk when actual risk may exist. Regardless of the inclusion of accumulation factors, other uncertainties exist that could affect the estimation of true risk associated with WAG 9. Table 11-6 summarizes the results of the WAG 9 ERA evaluation.

Table 11-2. Contaminant risks greater than 1E-06 and less than 1E-04 for OU 9-04 exposure sites, scenarios, and pathways.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Cancer Risk	Exposure Pathway Excess Cancer Risk
ANL-01A-MCTBD	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	1E-05	1E-05
	0-25- and 30-55-year Occupational	External Radiation Exposure	U-238	2E-06	2E-06
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic	5E-05	5E-05
	100- and 1,000-year Residential	External Radiation Exposure	U-238	4E-06	4E-06
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	5E-06	5E-06
ANL-01-IWP	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	5E-06	5E-06
	0-25- Occupational	External Radiation Exposure	Co-60	6E-06	9E-04
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic	7E-05	7E-05
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	8E-06	8E-06
ANL-01-Ditch A	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	4E-06	4E-06
	0-25- and 30-55-year Occupational	External Radiation Exposure	U-238	5E-06	5E-06
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic	3E-05	3E-05

Table 11-2. (Continued)

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Cancer Risk	Exposure Pathway Excess Cancer Risk
	100- and 1,000-year Residential	External Radiation Exposure	U-238	9E-06	9E-06
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	4E-06	4E-06
ANL-01-Ditch B	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	2E-06	2E-06
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic	2E-05	2E-05
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06
ANL-01-Ditch C	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	2E-06	2E-06
	0-25- Occupational	External Radiation Exposure	Co-60	1E-06	2E-05
	0-25- and 30-55-year Occupational	External Radiation Exposure	U-238	2E-05	2E-05
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic U-238	2E-05 2E-06	2E-05
	100- and 1,000-year Residential	External Radiation Exposure	U-238	3E-05	3E-05
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06
ANL-09-Canal	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	3E-06	3E-06

Table 11-2. (Continued)

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Cancer Risk	Exposure Pathway Excess Cancer Risk
	0-25-year Occupational	External Radiation Exposure	Co-60	2E-06	5E-04
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic	3E-05	3E-05
	100-year Residential	External Radiation Exposure	Cs-137	8E-05	8E-05
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06
ANL-09-Mound	0-25-year Occupational	External Radiation Exposure	Co-60	1E-05	
			U-238	2E-06	8E-04
	30-55-year Occupational	External Radiation Exposure	U-238	2E-06	4E-04
	100-year Residential	External Radiation Exposure	U-238	3E-06	1E-04
	1,000-year Residential	External Radiation Exposure	U-238	3E-06	3E-06
ANL-35	0-25-year Occupational	External Radiation Exposure	Co-60	2E-06	
			Cs-137	5E-05	
			U-238	2E-06	6E-05
	30-55-year Occupational	External Radiation Exposure	Cs-137	3E-05	
			U-238	2E-06	3E-05
	100-year Residential	External Radiation Exposure	U-238	3E-06	
			Cs-137	9E-06	1E-05
ANL-53 South	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	2E-06	2E-06
	100- and 1,000-year Residential	Ingestion of Soil	Arsenic	2E-05	2E-05
	100- and 1,000-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06

Table 11-2. (Continued)

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Cancer Risk	Exposure Pathway Excess Cancer Risk
ANL-61A	0-25- and 30-55-year Occupational	Ingestion of Soil	PCB's	7E-05	7E-05
All WAG 9 sites (Cumulative Pathway)	100- and 1,000 year Residential	Ingestion of Groundwater	Bis(2-Ethylhexyl) Phalate	4E-06	
			Methylene Chloride	7E-06	1E-06
	100- and 1,000 year Residential	Inhalation of water vapors from Indoor Water Use	Methylene Chloride	1E-06	1E-06
10-06 TREAT Windblown	30- year Residential	Ingestion of Homegrown Produce	Sr-90	2E-06	2E-06
10-06 Stockpile	100-year Residential	External exposure	Cs-137	1E-05	1E-05
All WAG 9 sites (Cumulative Pathway)	100- and 1,000 year Residential	Ingestion of Groundwater	Bis(2-Ethylhexyl) Phalate	4E-06	
			Methylene Chloride	7E-06	1E-06
	100- and 1,000 year Residential	Inhalation of water vapors from Indoor Water Use	Methylene Chloride	1E-06	1E-06

Table 11-3. Contaminant risks greater than 1E-04 for OU 9-04 exposure sites, scenarios, and pathways.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Cancer Risk	Exposure Pathway Excess Cancer Risk
ANL-01-IWP	0-25-year Occupational	External Radiation Exposure	Cs-137 Ra-226	8E-04 1E-04	9E-04
	30-55-year Occupational	External Radiation Exposure	Cs-137 Ra-226	4E-04 1E-04	5E-05
	100-year Residential	External Radiation Exposure	Cs-137 Ra-226	1E-04 2E-04	4E-04
	1,000-year Residential	External Radiation Exposure	Ra-226	2E-04	2E-04
ANL-09-Canal	0-25-year Occupational	External Radiation Exposure	Cs-137	5E-04	5E-04
	30-55-year Occupational	External Radiation Exposure	Cs-137	2E-04	2E-04
ANL-09-Mound	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	8E-04
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	4E-04
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	1E-04
ANL-61A	100-year Residential	Ingestion of Soil	PCBs	6E-04	6E-04
	1,000-year Residential	Ingestion of Soil	PCBs	6E-04	6E-04
	100-year Residential	Ingestion of Homegrown Produce	PCBs	2E-04	2E-04
	1,000-year Residential	Ingestion of Homegrown Produce	PCBs	2E-04	2E-04
All WAG 9 sites (Cum Pathway)	100- and 1,000-year Residential	Ingestion of Groundwater	Arsenic	3E-04	3E-04
	100- and 1,000-year Residential	Inhalation of vapors from indoor water use	Arsenic	1E-03	1E-03

Table 11-4. Contaminant hazard index greater than 1 for OU 9-04 exposure sites, scenarios, and pathways.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Hazard Quotient	Exposure Pathway Hazard Index
ANL-01-IWP	100- and 1,000 year Residential	Ingestion of Soil	Arsenic	0.3	
			Chromium (VI)	0.8	1
		Ingestion of Homegrown Produce	Zinc	0.4	
			Mercury	0.5	1
ANL-01-Ditch A	100- and 1,000 year Residential	Ingestion of Homegrown Produce	Zinc	0.1	
			Mercury	0.9	1
ANL-01-Ditch B	100- and 1,000 year Residential	Ingestion of Homegrown Produce	Zinc	0.8	
			Mercury	0.5	1
All WAG 9 sites (Cumulative Pathway)	100- and 1,000 year Residential	Ingestion of Groundwater	OCDD	3E-01	
			2,4,5-TP (silvex)	2E-01	
			Antimony	2E-01	
			Arsenic	1E+00	
			Cadmium	6E-01	
			Fluoride	1E+00	
			Selenium	2E-01	
			Zinc	2E-01	5

Table 11-5. Sites retained for evaluation in the feasibility study because of human health risks.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Cancer Risk	Exposure Pathway Excess Cancer Risk
ANL-01-IWP	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	
			Ra-226	1E-04	9E-04
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	
			Ra-226	1E-04	5E-05
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	
			Ra-226	2E-04	4E-04
	1,000-year Residential	External Radiation Exposure	Ra-226	2E-04	2E-04
ANL-09-Canal	0-25-year Occupational	External Radiation Exposure	Cs-137	5E-04	5E-04
	30-55-year Occupational	External Radiation Exposure	Cs-137	2E-04	2E-04
ANL-09-Mound	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	8E-04
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	4E-04
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	1E-04

The basis of the toxicity reference values (TRV's) developed for nonradionuclides evaluated in the OU 1-10 ERA is the effect to the individual. This conservative approach is very commonly used due to the large uncertainty inherent in extrapolating effects data from test to field organisms. In this assessment, TRV conservatism is also compounded by the limited level of exposure modeling (i.e., transport of contaminants in the food chain from the surface to subsurface). However, it is given that individual ecological receptors are presented greater exposure than human occupational scenarios. The assessment of nonradionuclide contaminated sites resulted in assessment endpoints not being obtained [i.e., hazard quotients (HQs) greater than one], at eight sites (ANL-01, ANL-01A, ANL-04, ANL-05, ANL-09, ANL-29, ANL-35, and ANL-36). The complete list of contaminants that exceed the HQ are shown in Table 6-20 of this document.

Table 11-6. Summary of the sites with hazard quotients exceeding criteria for ecological receptors.

	Nonradionuclides		Radionuclides	
Site	Metal	Non-metals	Internal	External
ALN-01	•			
ANL-01A	•			
ANL-04	•			
ANL-05	•			
ANL-09	•			
ANL-29	•			
ANL-35	•	•		
ANL-36	•			

• Sites with hazard quotients exceeding criteria for ecological receptors.

The approach for evaluating radionuclides at WAG 9 for ecological receptors is discussed in detail in Section 6 and is based on a population effect level. Using this methodology, no sites at WAG 9 exceeded assessment endpoints (i.e., had HQ greater than 1 for radionuclides).

A basic assumption of the ERA is that, under a future use scenario, the contamination is present at an abandoned site that will not be institutionally controlled. In actuality, co-located facilities are currently in use, and institutional controls will remain in place until they are decommissioned, at which time they will be reassessed. Since these sites are at an industrial facility that is currently in use, they most likely do not contain desirable or valuable habitat. The absence of habitat, facility activities, and institutional controls will minimize the exposure of ecological receptors to levels that could be considered acceptable.

It is important to reiterate that it was anticipated that the conservative nature of the ERA at the WAG level would result in many sites and contaminants being indicative of risk to ecological receptors. This is due to the exposure calculations using a very conservative approach and is also compounded by the methods used to determine extent of contamination and characterize exposure concentrations at each release

site. It was assumed that the total area of the site was contaminated at the 95% UCL or maximum contaminant concentration resulting in an unrealistic exposure scenario. More importantly, risks to individuals (vs. population-level effects) were assessed. It is anticipated that additional biotic and abiotic sampling and analyses, and field-validated exposure modeling performed at the INEEL-wide level will reevaluate this risk at a more ecologically relevant level.

ANL-W has arbitrarily set a screening HQ of 10 times the HQ using the INEEL background concentration for the ecological sites. Because of the overly conservative estimating methods, any site that has a hazard quotient for any COPC greater than 10 times the HQ for background will be evaluated in the feasibility study. OU 9-04 sites that have HQs of 10 or less were screened from inclusion in the feasibility study. As shown in Section 7.1.2, the screening of ecological sites eliminated three sites from inclusion in the feasibility study. These three sites are ANL-05, ANL-29, and ANL-36. These three sites (ANL-05, ANL-29, and ANL-36) only had one contaminant with HQs greater than 1.

11.5 Alternatives Evaluated in the Feasibility Study

The feasibility study evaluated the release sites that were identified in the BRA and ERA and shown to pose unacceptable risks to human health and the environment. The feasibility study further identified five remedial alternatives and evaluated each on their ability to reduce the risk to human health and the environment by eliminating the exposure pathway or reducing the source of the risk. Of the five alternatives four were retained and extensively evaluated using the nine CERCLA criteria. Two alternatives were screened because they did not meet the remedial action objectives by eliminating the exposure pathway or reducing the source. The DOE, along with the other regulatory agencies (IDHW and EPA) will evaluate the remaining alternatives and select the preferred alternative for use at WAG 9. This preferred alternative will then be presented to the public and any comments that are received will be reviewed and incorporated when appropriate. The selected remedial action alternative will then be chosen and implemented at ANL-W.

Five remedial alternatives for sites that were developed for the OU 9-04 FS are listed below:

- Alternative 1: no action
- Alternative 2: limited action
- Alternative 3a and 3b: excavation and containment
- Alternative 4: excavation and disposal off-site
- Alternative 5: phytoremediation.

11.5.1 Alternative 1: No Action.

Formulation of a No Action alternative is required by the National Contingency Plan (NCP) [40 CFR 300.430 (e)(6)] and guidance for conducting feasibility studies under CERCLA (EPA 1988). The No Action alternative serves as the baseline for evaluating other remedial action alternatives. This alternative can include environmental monitoring, but does not include any actions to reduce potential exposure pathways, such as fencing or deed restrictions (EPA 1988). Therefore, the No Action alternative

developed for the retained OU 9-04 sites involves only environmental monitoring (groundwater, air, and sediment) for at least 100 years after ROD signature (1998).

11.5.2 Alternative 2, Limited Action

A limited-action alternative was developed that involves only institutional controls to remain in effect for a minimum of 100 years. This alternative essentially continues management practices currently in place at OU 9-04. Actions under this alternative focus on routine maintenance and upkeep of the drainage ditches and disposal pond, restricting access (fences and deed restrictions), and environmental monitoring including radiation surveys.

Cap integrity monitoring and radiation survey programs would be established to ensure the functionality of existing surface soil covers where they exist, and would provide some early detection capabilities for potential contaminant migration. These programs would be implemented annually for the first 5 years following site closure. The need for further environmental monitoring would be evaluated and determined by the Agencies during subsequent 5-year reviews (see Section 7.5.2). This alternative was screened from the detailed analysis because it did not meet the RAOs. But, activities such as deed restrictions, access restrictions, monitoring, and fencing can be added to other alternatives that were retained.

11.5.3 Alternatives 3a and 3b Containment

Two containment alternatives were developed for contaminants at OU 9-04. Alternative 3a evaluated an engineered soil cap and Alternative 3b used a native soil cap. The engineered barrier containment alternative (3a) developed for OU 9-04, radiologically contaminated soils utilizes the barrier designed for the SL-1 burial ground and consists of geologic materials including native soil, gravel, basalt cobbles, and rip-rap. Variations from this conceptual design are possible based on layer thickness, layer materials, layer order, location of the biobarrier in the cap profile and other considerations. The preconceptual designs identified for containment alternatives in the FS would be developed during remedial design and modified as needed to meet defined functional and operational requirements, with the concurrence of regulatory agencies. The second containment alternative (3b) uses native soil as the cap material. Both containment alternatives would require additional monitoring of the air and groundwater in addition to radiological surveys and cap inspection over the contained soils.

Only one capping technology (3a) met the RAOs by eliminating exposure pathways identified in the baseline risk assessment (BRA). Both containment alternatives met the RAOs for the radiologically contaminated soils, but only Alternative 3a met the RAOs for sites contributing to ecological concerns. Human health risks due to radionuclides decline to acceptable levels within 130 years for Cs-137 and 1,600 years for Ra-226. Ecological risks are predominantly caused by inorganics, which are assumed to remain indefinitely. Containment technologies must be designed to maintain their integrity for the period that unacceptable cumulative exposure risks will be present. The functional life of a particular cap design is based on erosion prevention, minimization of subsidence and settlement, prevention of slope failure, resistance to infiltration, resistance to biotic and human intrusion, and the materials used for construction..

11.5.4 Alternatives 4a and 4b: Removal and Disposal

Removal and disposal alternatives for OU 9-04 sites can be accomplished by using standard construction equipment to excavate contaminated soils and sediments, and disposing of the contaminated material by landfilling off site. The long term monitoring would not be required since the contaminated

material would have been removed. ANL-W evaluated two removal and disposal alternatives in the feasibility study. Alternative 4a used an on-site INEEL Soil Repository, while Alternative 4b used an off-site private disposal facility. Both alternatives meet the RAOs and were retained for detailed analysis in the feasibility study. These alternatives are identical with respect to the nine evaluation criteria with the exception of costs. The estimated costs associated with Alternative 4a are less than those for Alternative 4b because of the extra travel distance and increased tipping fee with the private facility.

11.5.5 Alternative 5, Phytoremediation

Alternative 5 is the only alternative that was retained during the screening that used a treatment technology to meet the RAOs. Phytoremediation uses engineered plants to remove the contaminants form the soil in-situ. Phytoremediaton has been used previously in the mining industry to remove inorganics from soils. Phytoremediation has also been used to treat radionuclide contaminants in soils and water. The advantages of using phytoremediation are that the costs are typically one-tenth those of disposal, and the soil is permanently treated to reduce the toxicity and mobility. This alternative was retained for further detailed evaluation in Section 10 and ANL-W is currently conduction bench-scale testing to determine if this technology works for the ANL-W COCs.

11.6 Land Disposal Unit

One of the release sites (ANL-01A—MCTBD) being investigated in the RI/FS was originally designated as a Land Disposal Unit (LDU) under the COCA agreement. This site was designated as a LDU because of the release of a caustic material that occurred after November, 1980. Because this site retained its LDU designation, special requirements were established in the FFA/CO Agreement for its cleanup. As stated in Section 1.3.1 of the Action Plan,

> ["Thirty Land Disposal Units (LDUs) were identified under the COCA. All 30 of these LDUs will be evaluated under this FFA/CO agreement. Units retaining the RCRA LDU designation will be remediated under the CERCLA process in accordance with the applicable substantive requirements of the RCRA/HWMA, if an unacceptable risk to human health or the environment is demonstrated" (DOE-ID 1991)].

ANL-W, has evaluated the risks for the ANL-01A—MCTBD site. The results indicate that the concentrations of inorganics, organics, and radionuclides do not pose unacceptable risks to human health. However, based on the conservative nature of the WAG 9 ecological risk assessment, the ANL-01A—MCTBD does have hazard quotients for inorganics that are greater than 1.

A conference call with IDHW/DEW was held on October 3, 1997 to determine the RCRA/CERCLA integration for the ANL-01A—MCTBD. It was determined that the MCTBD is a RCRA LDU and will be remediated under the CERCLA process in accordance with the applicable substantive requirements of RCRA/HWMA, if an unacceptable risk to human health or the environment is demonstrated. However, the Federal Facility Agreement and Consent Order (FFA/CO) has only adopted RCRA corrective action [3004 (u) & (v)], and not RCRA/HWMA closure. Therefore, upon completion of the remedial action, the DOE-CH must receive approval from the IDHW/DEQ director that the MCTBD has been closed pursuant to RCRA/HWMA closure requirements.

11.7 References

DOE-ID, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, State of Idaho Department of Health and Welfare, U.S. Environmental Protection Agency, U.S. Department of Energy, December.

LITCO, 1995, *Guidance Protocol for the Performance of Cumulative Risk assessments at the INEL*, INEL-95/131, Revision 0. May.

VanHorn, R. L., N. L. Hampton, and R. C. Morris, 1995, *Guidance Manual for Conducting Screening Level Ecological Risk Assessments at the INEL*, INEL-95/0190, April.